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PROCEEDINGS OF THE PHILADELPHIA FOUNDRYMEN'S ASSOCIATION.

The regular monthly meeting of the Philadelphia Foundrymen's Association was held at the Manufacturers' Club in Philadelphia on Wednesday, January 3, the president, Thos. I. Rankin, occupying the chair.

The meeting being the first in the new year it was made the occasion of a dinner, the association's initial venture in this direction. After coffee and cigars had been served the business of the evening was taken up.

The Executive Committee in their report stated: "There seems to be nothing but prosperity all over the land, the different iron works being busy in all sections of this country and Canada. A similar condtion is to be found in England, Germany, and other European countries. It is to be supposed that this state of things will continue until such time as overproduction is in evidence, but when that will be no one can tell. The prospects are that 1900 will be the banner year of these good times. Some of our larger foundries are filled with orders for castings to such an extent that other foundries are being called upon to assist in filling them. The prices of pig iron, scrap and other material seem to be about as high as they have been at any time, and there is no promise of reduction as yet. Foundrymen are urged,

XUM

therefore, to demand a price for their products commensurate with these conditions."

The treasurer's report showed the organization to be in a good financial condition.

A letter from Geo. H. Hull, president of the American Pig Iron Storage Warrant Company, was read, in which he expressed regret at his inability to be present that evening to read a paper, as announced in the call for the meeting, but promising to read the paper at the February meeting of the Association.

A communication from a New York concern asking for the experience of members of the association as to the use of 10 to 12 per cent. of ferro-carbon in castings was referred to the next meeting.

Routine business being disposed of, the remainder of the evening was spent in listening to addresses from those present.

Chairman Rankin made an excellent toastmaster, and introduced the speakers in happy terms.

Mr. Rotherham of Melbourne, Australia, was one of the first speakers. In the course of his remarks he said that in Australia, where he had lived for 20 years, there was but little casting done, but that little included the casting of a metal in which those present that evening perhaps would be little interested owing to their wealth—gold. The output of that metal, he said, last year amounted to over $70,000,000. Speaking of industrial questions, he said that he was particularly proud of the country of his adoption on account of the interest taken by its different governments in the labor questions. These questions, he said, between employers and employees were settled by the governments, and the arbitration and conciliation laws were in full swing. Since the law was passed and placed on the statute book, he said, there had been no strikes. The laborers had the right to appeal to a power called the Conciliation Board and state their case. If the decision of the board was not acceptable to both parties either party could appeal to the Supreme Court. Up to this time, he said, a period of six years, there had been no such appeal. He also referred to the step taken by the governments within the

past 18 months toward building a nation by the formation of a commonwealth embracing all the governments. As a people, he said, Australians knew they were great, but their modesty was such that they hesitated to say so. The difference between an Australian and an American was this, he said: The former was naturally modest and slow to say what he thought or believed; the latter was not so inclined. He was great by his achievements, his country was great, he knew he was great and generally said so. Australia was a large country—larger than the whole United States exclusive of Alaska. Sidney was a city of nearly 500,000 people. Within a radius of 12 miles of her post office were hundreds of miles of coast line, accommodating large ships drawing 40 to 50 feet, and enabling them to discharge on the streets of the city. Melbourne was, as George Augustus Sala had said, a marvelous city. It was a city of nearly 600,000 people, and the streets as wide as Philadelphia's Broad street, some of them very much wider. Carts were not allowed to unload on the streets, therefore the streets were never disfigured by loading and dumping on the footways. The business of the country was mostly export. Between 1861 and 1891 the export business increased threefold, and between 1871 and 1891 twofold. In 1898 the imports were $327,000,000, while the exports were $358,000,000. It would be seen that any country whose exports exceeded its imports was proceeding in the right direction. As a country is was richer per capita than any other country, and there was more money spent per capita. The output of gold in 1898 was $62,000,000, but 1899 would probably have produced close to $80,000,000. The wool clip for 1899 was valued at $115,000,000. These facts were quoted to show that where the per capita production and the spending powers were such as existed in Australia, that country should prove a good one for the manufacturer.

Ex-President Wanner followed. After listening to Mr. Rotherham he thought all would notice that there was a movement forward in his part of the world. Progress and advancement seem to be the order of things abroad. In regard to prices in the

XUM

foundry trade, he said that foundrymen must raise their prices themselves. Why should they crush each other in times like these? There was no occasion for it. It was confidence and determination alone which would uphold prices.

In introducing John Birkinbine to the company, the chairman referred to his recent work as engineer in chief of the National Export Exposition. Doubtless, he said, the wonderment was general when it was announced that the exposition was to be opened on a certain day, and everybody knew that at the time of that announcement, only a few months before the date mentioned, no preparation had been made. The fact that the opening was made on time, with everything ready, was a tribute to the skill of Mr. Birkinbine.

Mr. Birkibine, in a short and humorous address, spoke very highly of the zeal and earnestness of the men employed to carry out the details, and said that this enthusiasm contributed very largely to the successful opening. He referred to the fact that the whole enterprise was carried through from start to finish without loss of life or injury of any serious kind. In fact, he said, the only injury he had heard of was a case of a lady visitor having some teeth accidentally knocked out, and it was not even known whether the teeth were false or not. Speaking of the meeting that evening he said he wished to congratulate the association upon its progress. In regard to high prices of materials, he said that two years ago very few men were getting anything like a fair return for the labor employed and capital invested, but he would ask whether any member present could for one moment say whether the intrinsic value of pig iron had really doubled in two years. If that was so, then they could look straight ahead. If not, then they must watch for a time when matters would be different. He thought the whole condition of business should be considered in just the same light, and as to whether it was likely to prove continuous and for the benefit and further progress of the United States.

Other speakers were George Wiard, of the Wiard Plow Company; Thos. Devlin, of Thos. Devlin & Co.; E. S. Cook, of the

Warwcik Iron Company; Alfred Marshall, of the American Tin Plate Company; E. E. Brown, of E. E. Brown & Co.; S. A. Kensil, of the Tioga Foundry Company, and A. C. Pessano, of the Geo. V. Cresson Company.

PROCEEDINGS OF THE PITTSBURG FOUNDRYMEN'S ASSOCIATION.

Car wheel manufacture was discussed at length at the meeting of the Pittsburg Foundrymen's Association, January 22. Mr. A. V. Slocum was scheduled to read a paper entitled "Comparative Wheel Making," but owing to a sudden illness could not prepare the article, and was unable to attend the meeting. His brother, Mr. C. V. Slocum, formerly secretary of the Pennsylvania Car Wheel Co., now controlled by the Pressed Steel Car Co., volunteered to fill the gap, and gave an interesting address on car wheel foundry operations.

The severity of the tests to which the car wheels are put by the railroad companies before they are accepted was explained. He stated that the wheels are tested in lots of 103, three wheels of each lot being set aside for the purpose of being tested by the inspectors for the railroad companies. From each heat a standard test bar is secured and several other test pieces are also made. The test pieces are 1¼ or 1½ inches thick by 2 inches wide and 6 inches long, and are cast with the 2x6-inch face against the chill. The bar is given a transverse test, and in many cases showed more than 4,000 pounds. The test pieces are examined for depth of chill, etc.

The three wheels are next tested. They are picked at random from the lot. One wheel is selected for the drop test. The hammer weighs 140 pounds and drops a distance of 12 feet. It trips automatically, and the wheel must stand ten blows before being broken in two, or the entire lot of wheels is rejected. If the wheel is not broken in two with ten blows, it is hammered until broken. The depth of the chill on the broken parts of the wheel is then measured, and the metal examined to see whether it meets with the specifications. The other two wheels are then given the thermal test. The wheels are laid in sand, and molten metal is poured against the flanges and treads. The wheels must withstand successfully the expansion of the metal, and if they crack through the flange or tread in less than two minutes, the entire lot of wheels is rejected. If the wheels stand this test they are taken to a drop, broken, and again examined for the depth of

chill, thickness of plates, general quality of iron, and other tests. The entire lot of wheels is carefully examined by the inspectors for every visible defect, such as the thickness or thinness of flange, pin head bubbles, etc. If any wheels are found that have these defects they are thrown out, but their rejection does not necessarily affect the entire lot of wheels. Mr. Slocum added that the car wheel manufacturer must guarantee the wheels that pass inspection, for freight service for five years or to run 70,000 miles. If the wheel does not hold out this length of time it must be replaced by the manufacturer. If it can be proved that the wheels are slid flat or burned, the manufacturer cannot be compelled to replace them.

The speaker was asked whether other than charcoal iron had not proved satisfactory in the manufacture of car wheels. He replied that other irons have proved satisfactory in many respects, but do not give the chilling quality. Titanium has been used in the mixture and, in some instances steel, while in others coke iron has proved successful. If coke iron can be used successfully in the manufacture of wheels it would be much cheaper than the charcoal iron. The trouble with the coke iron, he explained, was that it did not give the depth of chill required by the specifications of most railroad companies, and was not used very extensively for that reason.

He mentioned molybdenum as one of the metals that had been used with some success in metal mixtures for car wheels, but its cost was so high as practically to prohibit its use for this purpose.

Mr. Slocum was then asked at what temperature car wheels were poured. He stated that the metal was poured as hot as possible and, as it takes from 10 to 13 seconds to make a cast, there would be practically a uniform chill. The chills are coated every cast with a mixture of varnish and shellac. This gives the tread a fine texture and lengthens the life of the chills. Two wheels cannot be made in one day with the same molds, for the reason that they must be allowed to cool before being used again. After the wheels are cast they are placed in annealing pits, where

XUM

they remain for from four to five days. Slow or rapid cooling, however, has no effect on the chill.

The different sizes of chills have been an eyesore for years to the car wheel manufacturer, said Mr. Slocum. The master car-builders, however, are getting together in the matter of chills, and the chief annoyance at present is from the street railways. The latter do not require as severe a test as the steam roads, but demand that the wheel be guaranteed for from eight to eighteen months. Street car wheels wear out more quickly than those of steam roads, partly because the motormen are so careless about sliding the wheels, and further because they are much lighter than those used for steam roads. The price of wheels then came up for discussion, and it was stated that old wheels bring more at present than new ones one year ago.

The manufacture of chilled iron wheels in Europe was next touched upon. In Austro-Hungary, Mr. Slocum stated, chilled iron wheels have been manufactured in recent years, the plant being constructed by American engineers. In France a foundry was erected last year, and one is to be built in England very soon. The initiative in the use of chilled iron, however, is from this country. The wheels extensively used in Europe at present are of wrought iron, and are welded together by hand. It requires 1,000 men to make 200 wheels per day by this process, while with chilled cast iron the same number of wheels can be made by less than 100 men.

Regarding the so-called paper wheel, Mr. Slocum said that its use was very limited. The rim is steel, and the hub is of iron. The center outside of the hub is of papier mache. Less than 10 per cent of the car wheels now in use are of this type.

At the business session of the association it was decided to amend the by-laws by changing the date of meeting from the fourth Monday in the month to the first Wednesday. This is in accordance with the movement among the various local organizations affiliated with the American Foundrymen's Association, to meet on the same night each month and to have the same papers read before each body the same evening. Secretary Zim-

mers reported nothing new with reference to the annual convention. At a previous meeting the association had expressed a preference for Boston.

PROCEEDINGS OF THE NEW ENGLAND FOUNDRYMEN'S ASSOCIATION.

The annual meeting of the New England Foundrymen's Association was held on January 10, at the Revere House, Boston. Members dined together at 6 and for the remainder of the evening the program was furnished by the executive committee. The following are the nominees presented for office for the ensuing year: President, Walworth O. Barbour, Barbour-Stockwell Co., Cambridgeport, Mass.; vice-president, George B. Buckingham, Arcade Malleable Iron Co., Worcester, Mass.; secretary, Fred F. Stockwell, Barbour-Stockwell Co.; treasurer, George H. Lincoln, George H. Lincoln & Co., South Boston. Executive committee—H. A. Carpenter, A. Carpenter & Sons Foundry Co., Providence, R. I.; T. H. Colvin, Colvin Foundry Co., Providence; B. M. Shaw, Walker & Pratt Mfg. Co., Watertown, Mass.; William Doherty, Doherty Bros., Lowell, Mass.; W. F. Durant, G. F. Warner Mfg. Co., New Haven.

A REVIEW OF THE FOUNDRY LITERATURE OF THE MONTH.

IRON TRADE REVIEW.

Under the caption, "1900 as a Year for the Foundries," this journal says:

The expansion in the demand for foundry iron in the past 12 months has been an interesting study to an important element in the iron trade. While all the 600-ton furnaces whose construction was completed, started or projected in 1899 belong in the Bessemer column, it is well known that with an occasional exception the 80 or 90 old furnaces that became active last year were started up to produce non-Bessemer iron—in nearly every case, foundry grades. This great addition to capacity meant a veritable revolution from the conditions of 18 or 20 months ago, when foundry furnacemen were holding meetings in the East to devise some scheme to limit production and save themselves from ruin.

The foundry trade has proved a reliable index to well diffused prosperity, and its record in the past year has probably not been equaled. About a year after the great crops of 1896, the malleable trade got the first effects of the turn in the fortunes of the American farmer. The next year the movement increased, having meantime been augmented by the railroad buying that was itself the fruit of agricultural prosperity. The exports of American machinery made further demands upon the cupola. And as the furnaces, rolling mills and steel works began getting in shape to respond to the demand that was rising from every quarter, they completed the circle by their requisitions for the large tonnage of castings required to start up the inactive, equip the new, and re-enforce and enlarge the rest. As all industry was quickened by the large crops and the large exports and the inflowing gold of the three years following '96, machinery of all descriptions was in demand, and foundrymen who believed the days of a fair profit on castings had departed never to return found themselves courted, while for the privilege of naming the time of delivery customers offered figures not paralleled in years.

How the foundry trade has been responding has been evident

XUM

in every quarter. Melting capacity has been greatly increased by the putting in of new cupolas. The building of new foundries and the enlargement of the old has been steadily pushed since the spring of 1899. Busy concerns have put out work right and left where those not so crowded could be found to take it on contract. Idle foundries have been looked up and leased—these often being in other cities. New foundry construction has been pushed in every section. Malleable and steel foundry construction has had an impetus not known in years. But gray iron, machinery and general jobbing foundries have been even more conspicuous in the revival. Foundries working in a limited way on a specialty have widened out into the general jobbing field, and have taken contracts never before considered within their capabilities.

It has been said in the past few months that the high prices of pig iron were likely soon to affect foundry operations, as high rolled products were bound to limit building and other operations. But indications are—and these appear not in individual instances but in a multitude of cases in many directions—that the foundry demand for iron in 1900 will be materially in excess of that for 1899. Much of the additional cupola capacity referred to was only completed late in the year, for contracts taken to run months ahead. Even with so large a furnace capacity available as that which is now active, there is everywhere such a call for iron by the foundries as indicates that a day's banking of all the furnces supplying them would cause a serious dislocation of operations. The rule with foundrymen as with furnacemen is that their full capacity is booked for months ahead.

Foundries like those making malleable for the agricultural trade, and those connected with implement concerns have no means of knowing how their melt for 1900 is likely to compare with that for 1899. They must wait to see how the machinery that has been built for this year's market moves off at the higher prices which necessarily must be asked for it. But in railroad malleables, in gray iron castings, machinery castings, mill and heavy work and the miscellaneous product of the jobbing foundries,

all the preparations of the past half year and the known calculations of many prominent foundries point to the largest tonnage by far of cupola metal in 1900 the country has yet known.

Writing of "The Chemist and the Foundry," Edward Kirk says:

I have visited many foundries and learned the opinions of many practical foundrymen on the application of chemistry in general foundry practice. While all are willing to adopt anything that will give greater certainty in the production of good castings, many are skeptical of the results that may be obtained from mixing iron by chemical analysis, this being the branch of foundry practice for which chemistry has been most strongly advocated and to which it has been most applied. This sentiment I have found to be due largely to the experience of foundrymen, who, having employed chemists and made a complete failure of mixing irons by analysis, have been compelled to go back to the old method of mixing by fracture and practical experience, or go out of business. Quite a number of firms have become so infatuated with chemical analysis that they have failed in business through the heavy losses entailed by mixing iron in this way. Among them was one of the oldest and largest car wheel works in the country. This firm mixed its iron by the analysis of its chemist for a number of years. I was informed by their foundry superintendent that they frequently broke up an entire cast of 300 wheels, after they were taken out of the annealing pits, for the reason that the mixture of iron did not give the required strength and chill. These losses, together with many wheels condemned after they had been put in use, compelled the firm to go into the hands of a receiver, and after reorganization the same parctice placed them in a receiver's hands the second time, and finally out of business.

The failure of the application of chemistry to foundry practice in cases investigated does not appear to have been due to chemistry, but to the chemists, who in making cases have shown themselves wholly incompetent to do the work required of them. At one large radiator works visited, a complete laboratory had been

XUM

fitted out at great expense and a chemist employed, who, when a determination was wanted at once would say: "The sky is too blue toady," or "the clouds are too low," "the atmosphere is too clear," or "too heavy," etc.; and the laboratory was abandoned as a failure. At another large foundry where failure was reported, the chemist was found to have made accurate determinations by submitting samples to other chemists. But after repeated failures to obtain desired results from his determinations it was found that he could not add up a column of ten figures correctly, and could not figure out the results of his determination and apply them to various irons to be used in a mixture for a heat.

In other cases where failures were reported, the chemists made the excuse that the sample was dirty, was too fine or too coarse, was not taken from the right part of the pig, the pig was not a fair sample of the iron, etc. To overcome these excuses for failure, pigs have been carefully selected, planed and polished, to remove sand and dirt, and samples taken from different parts of the pig, with no better results in the mixture, this experience being followed by the excuse that the reagent was not good, the apparatus was not of the latest improved pattern, etc. In fact, the foundry chemist, in many cases, appears to have taken the place of the old professional melter, who enveloped the management of the cupola in mystery, seldom melted a good heat, and for the many very bad ones melted always had an excuse which his employer was bound to accept, for the cupola was a mysterious foundry apparatus which no one but the old melter knew anything about.

These excuse-making melters were so accurately described in my work, "The Founding of Metals," published in 1877, that they have almost ceased to exist, and foundrymen are not likely to replace them by excuse-making chemists. If the chemist is ever to gain a foothold in the foundry, he will have to do it by the results of his determinations, and not by making excuses for his failures.

A man to be a foundry chemist must be thoroughly up-to-date, capable of making in the shortest possible time an accurate

analysis of all the materials employed in founding, such as metals, coke, coal, fluxes, fire brick, clay, sand, facing, etc. After making an analysis of these various substances and determining their component elements, he must be able to state positively if the material is suitable for the purpose for which it is to be employed in the art of founding. For example: After making a determination of the carbon, silicon, sulphur, phosphorus, manganese, etc., in irons submitted for analysis, he must be able to state if any one of the irons when remelted will possess all of the characteristics of an iron best suited for the work to be cast. If not, will a mixture of one or more of the irons produce an iron of the requisite quality, and what per cent of each should be employed in the mixture. Does a coal or coke submitted contain the requisite number of heat-producing units to do fast and economical melting? Does it contain elements detrimental to iron in sufficient quantities to affect unfavorably the quality of iron melted with it? Can such deterioration be overcome by changes in the mixture of iron if other fuel is not obtainable? Has a fire brick the necessary refractory properties to make a good cupola lining for the grade of fuel, flux and iron melted, or would another quality of brick last twice as long under the same conditions? Is a given clay suitable for cupola daubing, ladle lining, loam cores, etc.? Has a sand the requisite properties of a good molding sand? Will it give a smooth surface in light work, or withstand the action of a large body of molten iron in heavy work? Will a facing wash before the molten iron become damp so rapidly that it can not be slicked or the pattern returned, produce a smooth casting, harden the iron, etc.? Is the limestone or other material suitable for a cupola flux, will it keep the cupola working open and full throughout the heat, clean and improve the quality of iron, protect the cupola lining, or cause it to burn out more rapidly?

All these points—and many more—must be determined by the foundryman before he can produce first-class castings. At the present time they are determined by what is known to the practical foundryman as experimental or trial foundry practice, and

XUM

to those unfamiliar with the details of foundry work, as the "rule of thumb" foundry practice.

If the material used in forming a mold does not produce a perfect casting, or the iron used does not possess the required degree of hardness, softness or strength, the casting is condemned and broken up, and the cost of determining the suitability of foundry material is represented by the cost of these condemned castings, and the cost of the condemned material, which may remain on hand for years or be thrown in the dump. The loss on such material is no small matter in many cases, as we have frequently seen tons of condemned iron lie in the foundry yard for years, barrels of blacking stand around until the barrels fall to pieces and the blacking was thrown in the dump, and piles of molding sand and clay reach the same destination after repeated failures to use them successfully.

If the chemist can determine the suitability of these various materials for the purpose for which they are to be employed in founding, at a less cost and with more certainty than by the present method, then the foundryman wants the chemist. If he cannot, the foundryman has no use for him.

To do this, the chemist must have some practical knowledge of the art of founding to enable him to apply the knowledge he has obtained by his analysis, and produce in the castings the results indicated by his determination, and to overcome the prejudice or ignorance of the foundry foreman, melter and molders. For instance, a melter from ignorance or habit may not make up his cupola in the best shape for melting. He may charge the fuel by counting the shovels, weigh the iron by counting the pigs and shovels of scrap, place too much or too little fuel in the bed and charges, melt iron too high or too low in the cupola and with uneven temperature. From prejudice against the chemist, he may not weigh the iron accurately or use the proper per cent of different grades in the mixtures; mix the iron in charging unevenly, etc. Pig and scrap, when not properly charged, and the cupola tapped close, will give all pig in one ladle and all scrap in another. High silicon and low silicon irons, hard and soft irons

may be drawn in the same way. Iron melted too high in the cupola is hardened, and iron melted fast and slow, hot and dull, in the same heat, is not of the same degree of hardness, softness, or strength throughout the heat.

It will thus be seen that a chemist who has no practical knowledge of the management of the cupola, is entirely at the mercy of a poor or prejudiced melter, and can never be certain of the results of a mixture made according to his determination. To overcome this difficulty and make himself master of the situation, the chemist must be a thorough practical melter, capable of chipping out and daubing up a cupola in the best possible shape for melting, and make up the cupola for a heat. He should know the exact amount of fuel required for the bed and each charge, and the exact amount of iron to be melted on the bed and each charge of fuel; when the bed is properly burned for charging; the mixing of irons in charges to produce an even mixture when melted; and to melt an equal amount of iron of an even temperature every minute from the beginning to the end of the heat. It is not necessary that the chemist should do all his work, but he should be able to instruct the melter how to do the work, have full charge of him, and see that the work is correctly done, and the best possible results in melting obtained from the cupola.

He must also be able to defend his iron in the castings, for there is no mechanic on earth that can give more plausible excuses for bad workmanship than the poor molder. When a casting is condemned and broken up, the chemist must be able to say from the fracture whether the iron is hard or soft. If hardness in a casting is due to the iron, wet molding sand, hard ramming, finishing the mold with a swab, strong facing, etc. If there is dirt in the casting, was it in the iron and could not be removed, or did it come from a dirty mold, careless skimming, bad pouring, etc.? He must be able to defend all material he has analyzed and recommneded for use in the foundry in the same manner.

Where is the foundry chemist to obtain this practical knowledge? There are no colleges that we know of in which foundry practice is taught, in connection with a course in chemistry.

XUM

There are no mechanical schools in which chemistry is taught, in connection with a practical foundry course. The chemist, after he has obtained his diploma from a college or other school, may take a course in foundry practice in one of the mechanical schools; but so far as we have been able to learn, this course is not especially adapted to the training of chemists in foundry practice, and the would-be foundry chemist after receiving his diploma in chemistry has been compelled to get his practical knowledge in the foundry at which he is employed.

Where the chemist has been a practical man as well as a chemist, and the foundryman has been a practical foundryman and given the chemist his hearty support, the chemist has been able to gain this practical knowledge and make foundry chemistry a success. But in cases where the chemist was not a practical man, or the foundryman did not give him his hearty support, foundry chemistry has been a failure, from lack of proper training of the chemist; and up to the present time foundrymen have derived more benefit from the blast furnace chemist than from the foundry chemist. This should not be the case, and would not be so if schools were established to give the foundry chemist a proper training for the work to be done. It seems to me that the trade or mechanical schools might well take up this branch of instruction, and give a practical course in foundry chemistry that will at least give the student some idea of what is required of him, and how to gain this practical knowledge when employed in a foundry.

"Cupola Malleables" is the subject chosen by E. H. Putnam for an article in this journal of January 25, in which he says:

I have written a number of articles lately on the manufacture of cupola malleables. These have been copied into various trade journals, giving them a pretty wide publicity. From letters of inquiry concerning the subject I find that there are numerour foundrymen who would be glad to take up the manufacture of the malleables used in their own business if they could see their way clear to profitable production. I have claimed that it is quite

practicable to manufacture with profit cupola malleables (i. e., malleables from iron melted in the cupola), on a small scale.

Many quite large buyers are paying as high as four cents a pound for agricultural machinery malleables. The net profit to the manufacturer of these malleables is more than a cent and a half a pound. At the prevailing price of pig iron, cupola malleables can be produced on a small scale at a cost of less than three cents a pound. This, I think, pretty nearly covers the claims that I have made in my previous articles on the topic. It occurs to me, however, that a word of caution may be necessary in connection with the question. While it is true that a product of, say, 300 tons per annum can be profitably joined with the manufacture of agricultural machinery, it is assumed that the manager is thoroughly familiar with the business. The manufacture of malleable iron castings is an entirely different kind of business, in the main, from that of gray iron founding. It would be very unfortunate if any one of my readers should act upon the assumption, from what I have written, that any good foundryman is qualified to take up the manufacture of malleable castings without a previous thorough education in the art.

It is no doubt true that most users of malleable product buy instead of manufacture; but that many of them could produce the goods for considerably less than they are paying is certain. There are various reasons for this situation. In the first place, when a manufacturing concern starts in business it is usually on a small scale, and a very inconsiderable quantity of malleable iron enters into the product, and this must perforce be bought outside. As time passes and the business grows, the hands of the officers are frequently so full as to preclude the possibility of taking up a radically different line of product. Furthermore, it often happens that land for shop room is entirely unavailable. In this connection I could name a great manufacturing concern that for something more than a dozen years past has purchased all of the chilled plow castings that enter into its product, simply because it is handicapped for room in its present factory, and there is no land for sale in proximity thereto. This company has, how-

XUM

ever, built a large malleable castings plant, and operates it with eminent success, making not only its own heavy tonnage, but also supplying hundreds of tons per annum to customers who might supply their own wants with equal success if they but knew it. But in this case the malleable factory is entirely disconnected from the other plant, both as to location and practical management. The principal owner probably knows very little about the practical manufacture of malleables. But this is no bar to the man who has the wisdom to employ men of ability rather than to sink his capital in a necessarily futile endeavor to conduct personally a business that he knows nothing about.

There is another reason why more concerns do not add to their business the manufacture of malleable iron. Some men are unconquerably averse to prosecuting any branch of business of which they personally are not masters. This, in some cases, is fortunate and in others it is unfortunate. The man of great executive ability will not hesitate to launch out in unfamiliar lines of manufacture if he is sure that others find it profitable, while the man who is wanting in this quality trembles at the thought of conducting a business of such magnitude that its details may lie beyond his personal touch.

Perhaps, however, the greatest of all obstacles to the manufacture of malleable iron castings by large consumers is the veil of mystery that has enshrouded the art in all the past. So firmly are people generally convinced that the processes connected with the production of malleable castings are involved, elaborate and mysterious, and withal hardly attainable, that they instinctively shrink from any attempt. And, naturally, the men who could tell them better will not do so, for men do not usually seek to build up competition against themselves.

The manufacture of malleable castings is a business that is destined to grow more rapidly than that of gray iron, for it is largely superseding gray iron in many classes of manufacture, notably agricultural machinery and railroad equipment. Some of the very large manufacturing concerns have a malleable castings plant in connection, and they are constantly displacing gray

iron castings with malleable, because with the latter a given strength may be attained with much less weight. This makes their goods preferable, and it is only a matter of time when the stress of competition will compel a general adoption of the plan. In view of this fact, it seems to me that manufacturers of agricultural machinery generally would but consult their own interests if they were to take up the study of malleable iron manufacture without delay.

Referring to a previous article appearing in The Iron Trade Review (reproduced in this number of The Journal), by Edward Kirk, Thos. D. West offers the following comments:

The able article of Dr. Edward Kirk emphasizes the chemist's responsibility for results in making mixtures. My experience and observation would not permit an indorsement of the views advanced. The one great mistake of some founders who endeavor to be guided by analysis in making mixtures is that they think the chemist should be held responsible for the final results, for the quality of the iron in the casting. There is about as much reason in this as there would be for a blast furnace manager to think of holding his laboratory responsible for the grade of iron coming from his furnace. All that is expected of the blast furnace chemist is that he analyze the materials going into a furnace and the iron coming from it. With materials of exactly the same character going into a blast furnace at different times wholly different grades of iron can come from them. In a measure the same is to be said of the cupola. Still further, after the iron has come from a cupola, he is a poor molder than cannot make two molds off the same pattern, one giving a different grade of iron from that of the other, both poured from the same ladle of metal.

To understand the hundred and one things that can change the grade of iron after it is charged into a cupola, put through the process of melting and at last poured into the mold, generally requires a long experience as a founder. A good chemist gives up several years of his early life to learning to make analyses and when he has done this it is all that should be expected of him,

so far as the responsibility for the grade of iron obtained in castings is concerned. The trouble with the founder who does not make a success of working by analysis lies with himself in not studying what effect varying percentages of silicon, sulphur, phosphorous, manganese, carbon, etc., may have in changing the grade of an iron. He conceives the idea somehow that a chemist should know these things and engages one to look after such work. It is not until much loss has been incurred by reason of the founder's and chemist's lack of knowledge, that the former either takes the matter in his own hands or condemns chemistry; whereas, had the founder but understood the chemist's proper place and his own duties before starting in to adopt analysis the work would have been successful. It is not to be understood that a chemist could not work up to the point of understanding as much as the founder might attain in this field. But even did the chemist work up to an understanding of results due to variations in the metalloids, the fact that the founder can change results after iron has been charged, makes the responsibility for final results in mixture one that I am sure a wise chemist would not accept. "Let the shoemaker stick to his last." The saying applies very forcibly to the founder who will not acquaint himself with the results of chemistry in making mixtures and thinks to have a chemist carry the load for him. The chemist's best place is in the laboratory, just as at the blast furnace, and a founder who would take a chemist out of his field to do work properly his own, deserves to reap the failure sure to come. The chemist's part in aiding the founder should be as independent of responsibility for good castings as is the work of the pattern maker, machinist, or blacksmith in assisting the founder to complete his appliances for making molds. The founder that pursues this policy and studies for himself the variations due to changing percentages of the metalloids will make chemistry in the foundry a success.

THE TRADESMAN.

Some general information concerning cupola practice is given by E. H. Putnam, from which we take the following:

From the very outset of our schooling in the art of founding

we are taught that when the blast is once turned on it must be kept up till the last of the work is poured. We all know how, when some accident befalls the fan, as, for instance, the breaking, or unlacing of the belt, the foreman, wild-eyed and half dismayed, rushes to the scene of disaster and shrieks his demands for haste in the matter of repairing. And everybody, catching the apprehensive infection, fairly trembles till the tense monotone of the blast pipe is once more heard. I grant you that in many foundries this anxiety concerning the blast is perfectly justified. If you are trying to melt the utmost possible weight of iron with a given amount of coke, then look out for your blast. If you would rather conduct your melting along the beetling verge of imminent disaster in the hope of saving a little fuel, than to burn a little more coke in the smooth valves of safety, why, blaze away! "You pays your money and takes your choice." The fact is, this article is not being written for the "twelve-to-one" melter. Not but that the latter is all right, in his place; there is a class of work that will stand twelve-to-one iron, and under such circumstances the melter who can produce it is fortunate; and there are no doubt many such.

But there are a good many foundries that are using a cupola that is too small for their requirements because it is feared that a cupola much larger would necessarily melt the iron faster than it could be taken care of properly. And there are others, where they would like to continue the heat for a number of hours and yet melt slowly enough to enable a very few men to handle all of the iron. To such I will state that your cupola is susceptible of perfect control in this matter.

You cannot melt iron hot, and slow, with so small an amount of coke as will answer for hot and fast melting; but the difference in per cent of coke is not very great however. Assuming that the bed fuel is ample, and that for the succeeding charges you are using one of fuel to ten or iron, for good, hot, fast melting, and that you wish, for some reason, to greatly curtail production, confining it to a limited number of patterns, and therefore necessitating the employment of but few men; add, say, 60

XUM

pounds of coke to each charge, and you will be apt to strike it about right. Now, 60 pounds of coke divided into 2,000 pounds of iron is not much, under the circumstances in which you are here supposed to be placed. Put on the full blast, as usual, and when you are ready to tap into the ladles for the first time, shut off the blast. Now, supposing that your cupola is a 60-inch shell with 6-inch lining, and that you can man only two bull ladles, tap these full, and do not put on the blast again till the ladles have returned and have been tapped into for the second time. If you find that not enough iron has been melted to fill the ladles the second time, pour what you have, or turn on the blast long enough to melt the ladles full, then shut off the blast, stop up, and reopen the blast gate, continuing the blast not longer than a half minute, and not even so long a time if you have any fear that the melting will get the start of you. Having gone through these operations a number of times, you will be able to manipulate the blast exactly to your liking for the balance of the heat. You will be able to continue the heat for a number of hours in this way, melting as slow or as fast as you please, and the iron will be hot enough to run stove plate from beginning to end.

It may be that you will have to use a somewhat larger proportion of fuel than I have indicated, and perhaps you had better do so at the first trial, though in my own practice the ratio given has proven all right.

For this business the blast gate should be located within easy reach from the foundry floor. If, however, the gate is overhead and out of reach, place a boy there to manipulate it; he will soon learn exactly what to do, and will be able to control the melting speed to suit the convenience of the men engaged in pouring.

If your foreman does not happen to know all the possibilities in cupola management, do not conclude that he is an ignoramus and unfit for his position. Remember that necessity is the mother of invention, and that most of us would have known much less than we do if we had not been compelled to learn. It takes a good many long years to fill a man chock full of experience. If

you have need to employ the plan above described, just let the foreman read it, and ask him to try it. If he really tries he will succeed.

Every foundryman ought to study the cupola until he is complete master of it. Too many are mastered by the cupola, thinking, unfortunately, that there is no help for it.

While on this subject of cupola management, we might as well come to a better understanding about the tapping hole. Do you locate the bottom thereof on a level with the bottom of the spout? Now, don't all answer at once; because some of you do not—and some of you do. And you who do frequently have great difficulty in stopping up, toward the latter part of the heat. It is sometimes quite difficult, nay, impossible, to keep the spout perfectly clean and clear of all obstruction throughout a long heat; and if any sort of accretion happens to raise the bottom of the spout, next to the tap hole, above the original level, the iron will burst out under the stopping bod in spite of all you can do, and from this period to the end of the heat you will have a vexatious time of it. To obviate any danger of this sort of trouble, locate the tap hole so that the bottom thereof will be, say, at least three-quarters of an inch above the bottom of the spout. And when you tap out, never thrust the tapping bar into the tap hole. Have a short bar, and stand at one side, close up to the cupola preferably, and scrape away the stopping till the pressure of the iron forces a passage. Keep the breast about the tap hole clean and absolutely free from any accretion at all times.

Having determined the size of the tap hole, just bore a hole of that size through a smooth three-inch plank, then make the breast and tap hole of the cupola as near like it as possible. If you have never used this plan, but have been accustomed to reaming out the hole at the front, so as to cause the stopping bod to wedge into it, you will probably doubt its efficiency—till you shall have tried it. It is the having the correct shape and location that enables you to tap out and stop, and to keep all clean with perfect ease, without either enlarging or diminishing the size of the tap hole throughout a prolonged heat.

XUM

Line the cupola spout with split fire brick, laid in fire clay mixed with free (sharp) sand, and plaster over the brick with the same. See that the spout is thoroughly dried before putting on the blast, especially if the spout is a long one; because if not dry, the iron that first comes will solidify in the spout to such an extent as sometimes to cause much trouble.

THE FOUNDRY.

John Gunther illustrates a spring lifting hook in use at the foundry department of the Walter A. Wood Harvester Co.'s plant at St. Paul, Minn.

Eli H. Pearce shows how it is necessary for a molder to constantly keep his wits about him to guard against failure.

A subscriber of this journal asks about the methods employed in annealing castings and desires to obtain directions for getting up an inexpensive rigging for annealing in small quantities, to which the following reply is given:

We are always glad to procure for our subscribers any information we can obtain relating to the foundry business. We are inclined in the present instance, however, to think that we shall not be able to give our inquirer a, to him, satisfactory reply. The annealing of castings, we take it for granted our correspondent refers to malleable castings, has been dwelt upon by several writers in this journal during the past year or two, although we want to say that the annealing of castings, like the molding of same, is something that cannot be learned out of books altogether. We should advise the seeker after knowledge on this subject, who expects to put it into practical use, to visit establishments where annealing is being done. A little reading matter is a good thing at all times, but for the man who wants to succeed in a calling there is nothing like rubbing up against the real work itself. This applies whether it is running a locomotive, a sausage factory or an annealing oven.

When it comes to giving directions for getting up an inexpensive rigging for annealing in small quantities we are again confronted with our inability to give our subscriber what he asks

for. There is no such thing as an inexpensive rigging for annealing small quantities of castings. The very act of annealing castings that way is expensive. The most expensive rigging is generally the most inexpensive, that is when work performed and outlay is compared. However, if any of our readers will favor us with their methods of annealing castings in small quantities, we shall be pleased to publish same, although we caution our correspondent now, that the method will NOT be inexpensive.

The same party also desires to hear from those of our readers who have found a satisfactory ingredient which can be put into a ladle of melted iron to remove the slag and impurities and insure a clean casting in such jobs as rolls and the like which must finish up clean all over and are rejected for the least imperfection.

There has at different times been several nostrums placed on the market of which a few spoonfuls were guaranteed to remove all imperfections that appeared in the casting. We have never heard of one of these medicines accomplishing what was claimed for it, and what is more, we do not expect to. The way to get a nice clean casting is to have nice clean iron. By this is not meant an iron free from impurities, because all cast iron contains more or less of these in the form of graphite, silicon, phophorus, etc.; in fact, these elements are necessary in different proportions to obtain a casting of the quality sought. However, where a clean casting is wanted, and one that must be perfect, burnt cast iron, wrought iron and the like should be kept out of the mixture. With a suitable grade of pig and scrap iron a clean casting can be obtained if the iron is melted as it should be, when all unnecessary slag and impurities will rise to the surface of the metal, where they can be skimmed off before pouring, and the mold is made right. This includes the proper method of gating, for after all that has been said on this subject it is surprising the amount of dirty castings that are caused by not providing a suitable method for the iron to enter the mold.

Taking it altogether, the art of making good castings is one that every generation will have to learn for itself. A vast amount of printed matter showing how to obtain clean castings has ap-

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peared within the past decade, and the greater part of this has been contributed by men who have had a fair success in turning out creditable work; yet after all the "knowing how" to do this is not nearly so universally distributed as one would suppose.